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# ELEVEN IMPORTANT WILD-DUCK FOODS.

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## INTRODUCTION.

Accounts of the value, nature, range, and methods of propagation of various groups of plants having importance as wild-duck foods are contained in a series of contributions of the Biological Survey to publications of the Department of Agriculture, of which this bulletin is the third. Eleven groups here discussed include 2 assemblages of fresh-water plants of universal distribution in the United States; 2 of more southerly range; 2 trees of southern swamps whose abundant seeds are eagerly eaten by ducks; 1 strictly salt-water duck food, the first thus far recommended by the bureau; 1 brackish-water plant; and 3 others of such luxuriant growth as to be especially adapted for use on duck farms.

## MUSK GRASSES.

### VALUE AS DUCK FOOD.

Parts of musk grasses (algæ, Characeæ) have been found in the stomachs of the following 14 species of ducks: Mallard, black duck, pintail, wigeon, gadwell, green-winged and blue-winged teals, buffle-head, goldeneye, ruddy duck, little and big bluebills, ringneck, and redhead. The small tubers of these plants are eaten in large numbers; more than 1,100 were contained in the stomach of one goldeneye and more than 1,500 in that of a pintail. However, all parts of musk grasses are eaten. Certain ducks spending the late autumn on Currituck Sound, North Carolina, were feeding extensively on these plants. Three-fifths of the food of 70 little and 35 big bluebills taken in that locality in November, 1909, consisted of musk grasses. The stomachs of 3 pintails collected in the same locality in September contained on the average 52 per cent of musk grasses, and of 2 in October, 90 per cent.

NOTE.—This bulletin is for general distribution, and shows how 11 groups of plants may be successfully used as food for wild ducks in localities where now unknown, and is the third in a series on this subject, the preceding being Circular 81, Biological Survey, which treated of wild rice, wild celery, and pondweeds; and Bulletin No. 58, Department of Agriculture, which treated of the delta duck potato, wapato, chufa, wild millet, and banana water lily. The groups described in this bulletin are musk grasses, duckweeds, frogbit, thalia, water elm, swamp privet, eel-grass, wigeon-grass, water-cress, water-weed, and coontail.

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## DESCRIPTION OF PLANTS.

Musk grasses belong to the great group of plants known as algæ, which include forms commonly known as frog spit, green slime, and seaweeds. Most of the musk grasses (Characeæ) live in fresh water and are among the most highly organized algæ that do so. They are attached to the bottom, and over it often form a fluffy blanket a foot or more in thickness. Small round white tubers occur in numbers on the rhizoids (root-like organs) of some species. The slender stems are jointed and bear at the joints whorls of fine tubular leaves, which usually have a beaded appearance (fig. 1), due to the reproductive organs growing there. These are of two sorts: the antheridia, which are spherical and red when mature, and the oögonia, which are ovoid and black, more or less overlaid with white. The oögonia correspond to the seeds of higher plants, and are about half a millimeter in length.

FIG. 1.—A musk grass (*Chara*).

These plants are translucent and fragile, dull green in color, and often (*Chara*) incrusted with lime. This has given them one of their common names, limeweed. Other names are stonewort, fine moss (Michigan), oyster grass and nigger wool (North Carolina), and skunk grass (Massachusetts). The latter name and that here adopted for these plants, namely, musk grass, refer to a strong odor given off by a mass of the plants when freshly taken from the water.

## DISTRIBUTION.

Probably no part of the United States entirely lacks representatives of *Chara* or *Nitella*, our two genera of Characeæ. They require lime, however, and hence reach their best development in regions where that mineral is plentiful.

## PROPAGATION.

For transplanting, musk grasses should be gathered in quantity in late summer or fall, when some or all of the oögonia are mature. For

shipment they should be packed in small units (as in berry crates) open to the air on all sides. This will prevent fermentation; a little drying will not hurt. If they are to be transported long distances, the package should be iced. For planting, bunches of the plant may be weighted and dropped to the bottom. Growth should appear the following summer. Musk grasses will grow on almost any kind of bottom, but it must be remembered that they will not thrive permanently in the absence of lime.

## DUCKWEEDS.

### VALUE AS DUCK FOOD.

Duckweeds are abundant only under special conditions, but these conditions exist in some of the favorite haunts of our wild ducks. In the still recesses of southern cypress swamps, where duckweeds cover the entire water surface, these plants contribute to the support of all species of wild ducks. A statement of the duckweed content of two lots of stomachs collected at Menesha, Ark., in November and December will serve to show the importance of these plants in that locality. In the first lot were 8 mallards, and duckweeds composed an average of more than 62 per cent of their stomach contents. The proportion in other species was as follows: Spoonbill (1 stomach), 55 per cent; redhead (10), 50.3 per cent; and little bluebill (6), 8.33 per cent. In the second lot were 64 mallards, and they had eaten duckweeds to the average extent of more than 49 per cent. Fifteen ringnecks had consumed on the average 21.7 per cent each, and two wood ducks, 95 per cent. In the woodland ponds also of the Northern States duckweeds abound. Here in the breeding season the wood duck still manifests its preference for these little plants. Some stomachs are filled exclusively with them, thousands being present.

Duckweeds are relished by most of our ducks and have been found in the stomachs of the following species additional to those above mentioned: Pintail, gadwell, black duck, wigeon, blue-winged and green-winged teals, and big bluebill. As duckweeds sink at the approach of cold weather, they are available in the North during only the warmer months. In the South, however, they remain at the surface practically all the year.

### DESCRIPTION OF PLANTS.

The duckweeds most commonly seen are the green disks (sometimes more or less tailed on one side, fig. 2, *a*, *b*, *c*, *d*) which cover the surface of quiet and usually shaded waters. These disks are really leaves, the plants being reduced to a leaf, with one or a few roots on the under side. Duckweeds multiply largely by budding, and the parent plant and offsets often cling together in clusters. Individual plants vary in size from one-twelfth to three-fourths of an inch in diameter.

Two genera of duckweeds lack roots. One of these (*Wolffia*, fig. 2, *e*, *f*) contains the smallest flowering plants. These appear as green granules, one twenty-fourth of an inch or less in diameter, and are often abundant among other duckweeds or about the margins of lakes and ponds. When the hand is dipped into the water large numbers of the plants adhere to it. They look like coarse meal, except for their green color, and feel like it, so that a good name for them would be water meal.

The other genus of rootless duckweeds (*Wolffiella*) consists of strap-shaped plants (fig. 2, *g*, *h*), narrowed at one or both ends. They are from one-fifth to three-fifths of an inch in length and commonly cohere in radiate bodies or in large masses of less definite structure.

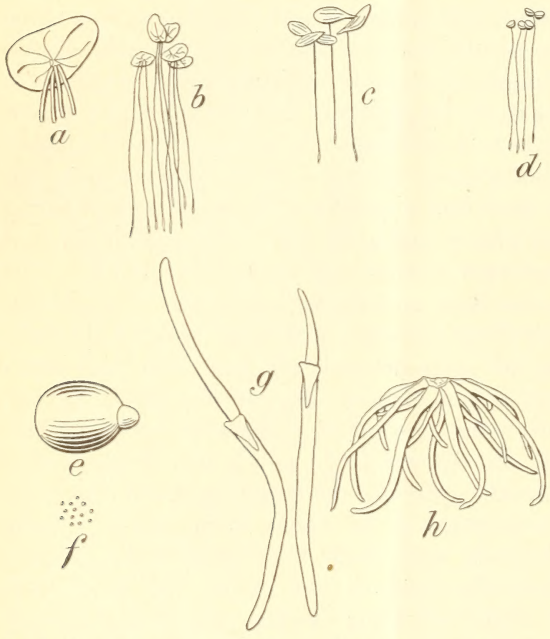


FIG. 2.—Duckweeds: *a*, *b*, *Spirodela*; *c*, *d*, *Lemna*; *e*, *f*, *Wolffia*; *g*, *h*, *Wolffiella*.

Duckweeds are known also as duck's meat, water lentils, and seed moss. The latter term, in fact, is used in Arkansas to cover all components of the vegetation of the water surface. Besides duckweeds, this mass includes that green or red, velvety, mosslike plant, *Azolla caroliniana*, and the branching straplike liverworts, *Ricciella*. Both of these are eaten by waterfowl along with the duckweeds, but being less plentiful are of minor importance.

### DISTRIBUTION.

Most of the species of duckweeds are wide ranging. Of the single-rooted kind (*Lemna*, fig. 2, *c*, *d*), 3 species occur throughout the United States, 2 others are confined to the southern part, and 1 to the eastern. The one many-rooted species (*Spirodela*, fig. 2, *a*, *b*), is of universal distribution. The granulelike rootless forms (*Wolffia*, fig. 2, *e*, *f*), so far as known, are confined to the eastern half of the country, and the straplike rootless species (*Wolffiella*, fig. 2, *g*, *h*) to the southeastern quarter.

#### PROPAGATION.

The seeds of duckweeds are minute and seldom mature. The plants, therefore, must be transplanted bodily. There is no difficulty about this, for if they are not crushed or allowed to ferment or dry, duckweeds are perfectly at home from the moment they are placed in a new body of water. Fermentation may be prevented by shipping in small units freely exposed to the air. Plants which are to be transported a long distance should be iced.

It is useless to put duckweeds in large open bodies of water. They thrive best in small pools and ditches where the water surface is rarely disturbed. In ponds entirely surrounded by forest growth and wooded swamps duckweeds also abound, but they are equally at home in small pools and other openings among the reeds and sedges of marshes. They are strictly fresh-water plants.

### FROGBIT.

#### VALUE AS DUCK FOOD.

Frogbit and the three species next described (thalia, water elm, and swamp privet) are at present known to be of only local importance as wild-duck foods. Frogbit is an abundant inhabitant of some of the shallow cypress-margined lakes in Avoyelles Parish, La. It produces spherical fruits filled with gelatinous matter in which are a multitude of seeds, eagerly sought by ducks. Nearly 18 per cent of the food of 308 mallards collected in that locality from October to March, inclusive, consisted of these seeds. From 8,000 to 10,000 were found in each of several stomachs and one contained 32,000. Other ducks found feeding on frogbit seeds were the pintail and ringneck. Twenty-five stomachs of the latter species collected in December contained on the average over 35 per cent of these eagerly sought seeds.

#### DESCRIPTION OF PLANT.

Frogbit (*Limnobium spongia*) floats in shallow waters, extending its roots into the muck below, or it may grow on soft mud itself. On stalks from a few inches to a foot in length are several heart-shaped leaves (fig. 3), which have 5 to 7 longitudinal veins springing from the base, and numerous cross-veins. The underside of the leaves is sometimes purplish. Numerous spongy runners help to support the plant in the water, and they also form new plants at the joints. The flowers emerge from conspicuous sheaths, and appear to have 3 sepals which are broader and sometimes reflexed and 3 petals which are narrow and more erect. The stamens, 6 to 12 in number, are given off at different heights from a central column. The stalks supporting the berrylike fruits are thick and recurved. The berry, as previously noted, is filled with a mixture of seeds and

gelatinous substance. The seeds are covered by minute tangled processes which cause them to cohere in masses. The fruit ripens in August.

### DISTRIBUTION.

Frogbit is a local plant, especially in the northern part of its range. It has been found at Braddock Bay, N. Y., Monmouth

FIG. 3.—Frogbit.

County, N. J., and in Delaware, but the normal range probably is from North Carolina and Missouri southward. The range here mapped (fig. 4) is not complete, since the plant has been found in Mexico.

### PROPAGATION.

Frogbit is extensively used in aquaria and water gardens, and may be obtained from dealers in plants for such purposes. The plants themselves should be set out in water a few inches deep over a mucky bottom or in soft mud near the water's edge.

## THALIA.

### VALUE AS DUCK FOOD.

The writer's only experience with thalia (species *divaricata*) as a wild-duck food was on St. Vincent Island, Florida. Here a slough filled with a tall growth of these elegant plants was a favorite resort of ducks, especially mallards, which could always be flushed from

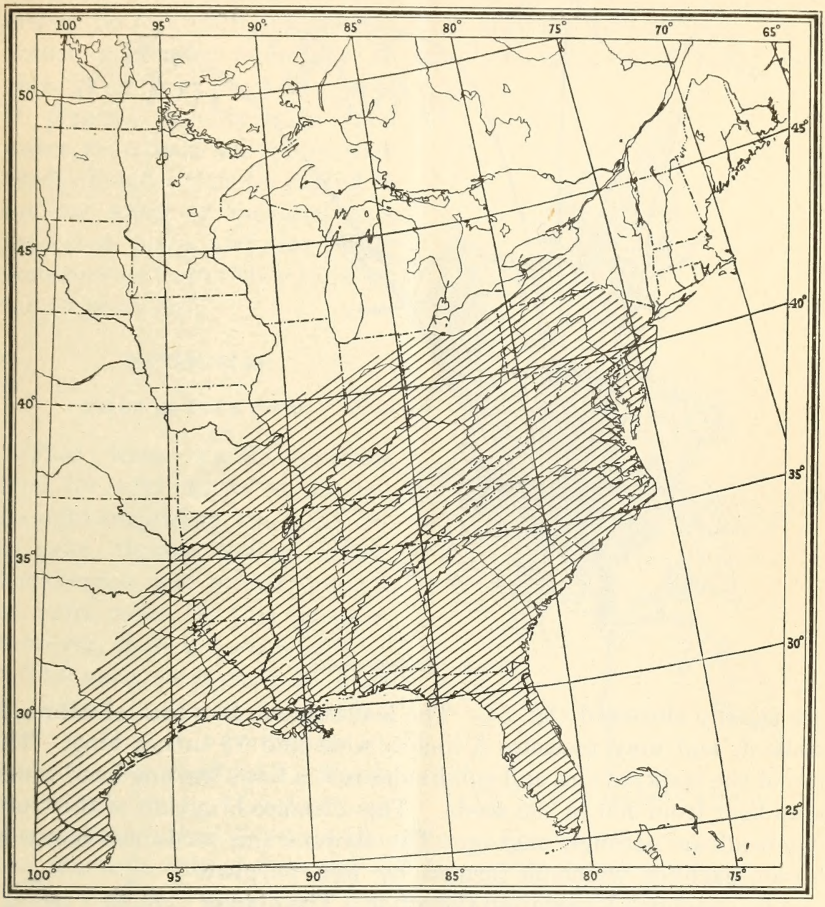


FIG. 4.—Range of frogbit.

this place. However, at the time of the writer's visit only one bird was obtained and its stomach contained a few thalia seeds. Another mallard collected at a later date in the same place, by the late Dr. R. V. Pierce, had fed almost exclusively on these large seeds, and its gullet and gizzard were well filled by 144 entire seeds and fragments of others.

The evidence is sufficient to show that thalia has great possibilities as a wild-duck food. The seeds are large and nutritious and are

borne in great abundance. They ripen in July and August and are available to ducks throughout the winter, if the water is not frozen over.

### DESCRIPTION OF PLANT.

A single plant of *Thalia divaricata* is a stout, one-leaved stalk from 4 to 15 feet in height, rising from a large tuberlike root, and the stems

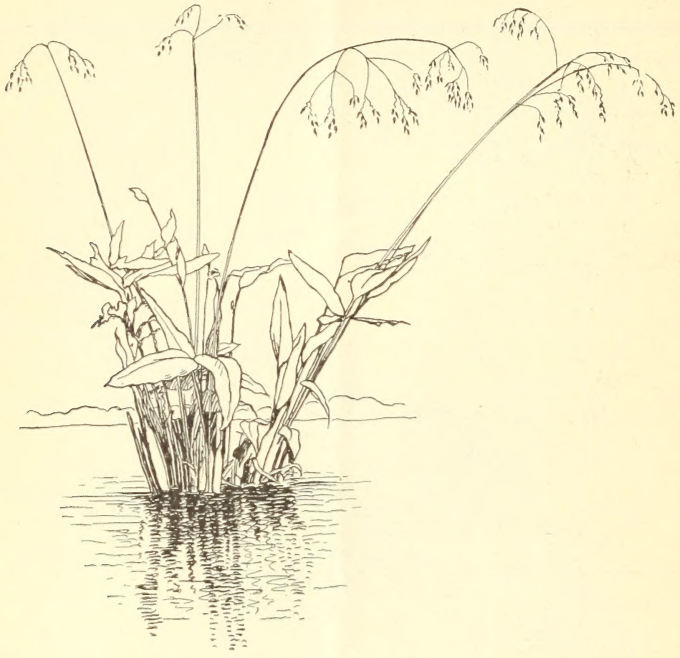

FIG. 5.—*Thalia divaricata.*

are usually clustered (fig. 5). The leaf is much like that of canna, is stalked, and may measure 5 inches wide and 15 inches long. The top of the stalk divides and subdivides into a large fruiting head which may bear from 200 to 300 seeds. The ultimate branches of the fruiting head are strongly zigzag. The flowers and seeds are borne in husks, each of which is formed by two purplish bracts, one much larger than the other. The oblong seeds (fig. 6) are plump and vary in length up to three-eighths of an inch. They have thin, closely fitting individual husks, are slightly curved, and bear numerous longitudinal rows of small irregular elevations which are lighter in color than the rest of the surface.

FIG. 6.—Seeds of thalia.

### DISTRIBUTION.

*Thalia divaricata* is native from Florida to southern Arkansas and Texas and southward into Mexico, and doubtless it will thrive as far

north as South Carolina and Missouri. Two other species (*T. dealbata* and *T. barbata*) occur in the region from South Carolina and Missouri south to Florida and Texas. Their value as duck food is unknown.

#### PROPAGATION.

Thalia can be propagated from either seeds or rootstocks. The seeds have a thick shell and the rootstocks are massive, so that neither should be injured if transported with ordinary precautions. Thalia occurs in greatest abundance in muddy sloughs, but it will grow in open water from 2 to 3 feet deep. If planted directly into open water, rootstocks should be used. Seeds should either be placed in shallow water or sprouted in a protected place and the young plants set out after they have attained some size.

FIG. 7.—Leaves and fruit of water elm.

### WATER ELM.

#### VALUE AS DUCK FOOD.

That trees should produce food for wild ducks is at first thought surprising, but many do, as oaks, thorns, hollies, ashes, hackberries, and others; none is of more value for this purpose, however, than the water elm.

The most common wild duck in central Louisiana is the mallard; in fact it outnumbers all other species combined. Foods important to it, therefore, are the important duck-foods of the region. One hundred and seventy-one mallards collected in the vicinity of Mansura and Marksville, during October, November, and December, had fed on the seeds of water elm to the extent of 45.5 per cent of their total subsistence. The largest number of seeds taken by a single duck was upward of 200. These tightly filled the whole gullet and gizzard.

Other species of ducks seem to be fond of the seeds, judging from smaller numbers examined from this region. These include the black duck and the ringneck. Water-elm seeds are eaten by Arkansas mallards also.

DESCRIPTION OF PLANT.

The water elm thrives in swamps and on the margins of sluggish streams. Normally it grows in water which is permanently 2 to 3 feet deep, but it survives prolonged inundation of much greater depth. The tree seldom exceeds 40 feet in height and 20 inches in diameter, and usually is much smaller.

The bark is much like that of the hop hornbeam or ironwood, and the leaves (fig. 7), while obviously similar to those of our other elms, are smaller and have blunter marginal serrations.

FIG. 8.—Seedlings of water elm.

The water elm flowers very early, from February to April, and the fruit usually ripens and falls in a month or six weeks, but occasionally is found on the trees as late as August. The extreme length of a single specimen of the fruit is about a third of an inch. It consists of a plump seed with a shiny blue-black coating, inclosed in a burrlike hull (fig. 7) which is ridged and provided with numerous fleshy projections. The fruits, which are very numerous, drop into the water immediately upon or even before ripening. Seedlings (fig. 8) come up by the thousand in midsummer and young plants in all stages of growth are abundant, proving that, for increase, seed is the main dependence of the tree.

The water elm is also known (in books) as planer tree, and among the French-speaking people of Louisiana as chataignier and charmille.

### DISTRIBUTION.

The range (fig. 9) of the water elm (*Planera aquatica*) extends from the lower Wabash Valley in Indiana to the river bottoms of eastern Texas, and from western Tennessee and southeastern North Carolina to Florida.

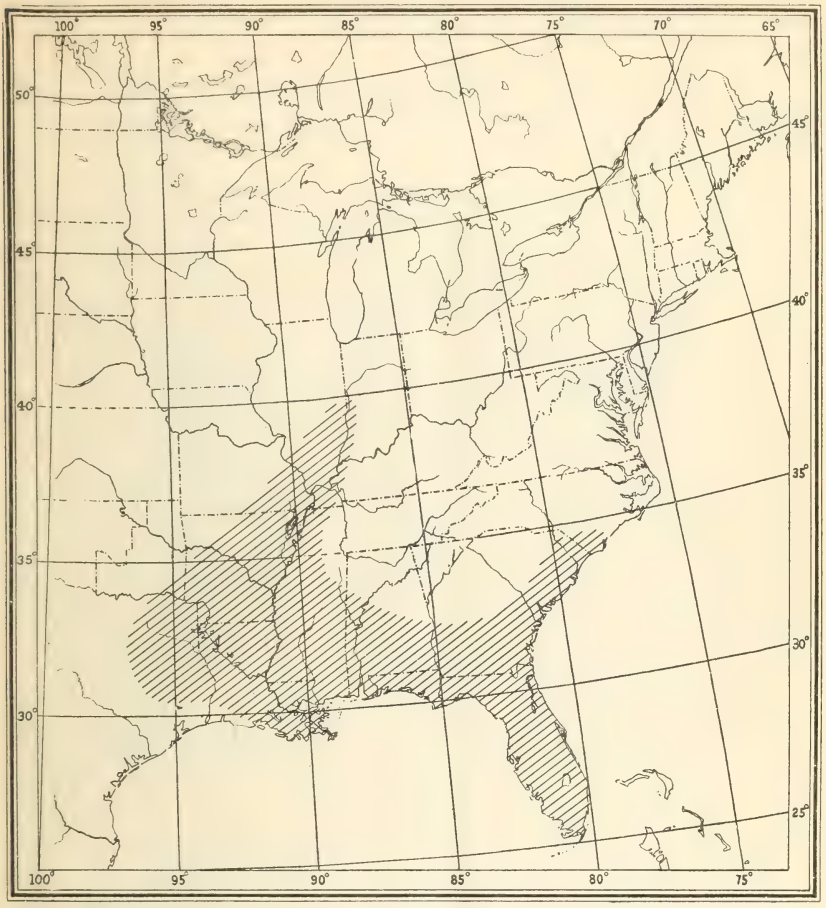


FIG. 9.—Range of water elm.

### PROPAGATION.

Seeds of the water elm do not seem to be ripe at the time they usually fall; the real ripening probably occurs as they lie in the water beneath the parent tree. While it is difficult, therefore, to collect seeds in proper condition for planting, young plants of water elm abound and if carefully lifted and packed should stand shipment well. Great care must be taken to prevent the roots from drying. They should be embedded in balls of earth and sewed up in burlap.

Transportation should be as rapid as possible and the young trees should be set out or heeled in immediately upon receipt. Transplanting should be done when the trees are leafless.

## SWAMP PRIVET.

### VALUE AS DUCK FOOD.

The swamp privet is included principally on account of the testimony of numerous hunters as to its usefulness. Wood ducks in particular are said to feed extensively upon its seeds. Weeks before other species of ducks arrive these birds are abundant in the country where swamp privet grows and are said to consume most of the crop of seeds, leaving little for other ducks. The seeds have been found in numerous mallard stomachs, but in quantity in only one.

FIG. 10.—Leaves of swamp privet.

### DESCRIPTION OF PLANT.

Swamp privet (*Forestiera acuminata*) or bois blanc, found in the same kinds of localities as the water elm, is a smooth-barked shrub (sometimes a small tree) usually with drooping stems, which frequently take root at the tip. The smooth, light-green leaves (fig. 10) are opposite, oval, taper-pointed at both ends, and with rounded serrations which are more prominent on the apical half. The fruit of swamp privet is a blue watery berry from one-half to three-fourths of an inch in length. Greatly subject to insect attack, it is usually distorted. The pit is nearly as long as the berry, pointed at both ends, and has numerous lengthwise, fibrous ridges. The seed within is white and smooth. The flowers, borne in clusters, bloom in March and April, and the fruit is ripe in May and June.

As is the case with seeds of the water elm, those of the swamp privet may remain under water for a long period without apparent deterioration. Probably most of the seeds are exposed by the annual lowering of the water level and germinate the summer they are produced. (See fig. 11.) Whether those which fall in deeper water ever

germinate is unknown, but it is certain, so far as utility as duck food in concerned, that they keep in perfect condition far into the succeeding spring.

#### DISTRIBUTION.

Swamp privet is native from central Illinois and Tennessee, near Nashville, south to Texas and Florida (see fig. 12).

#### PROPAGATION.

Fruits of swamp privet fully ripen upon the tree. The seeds, being protected by a fibrous cover and the pulp of the berry, undoubtedly will stand shipment for ordinary distances. Prompt handling

FIG. 11.—Seedlings of swamp privet.

is advisable, however, and the usual precautions against fermentation should be taken. The seeds should be sown in well-watered beds and the young plants grown to some size before setting out. Collected young plants and the offshoots produced by the rooting of the tips of branches of older ones may be handled like those of the water elm.

### EEL-GRASS.

#### VALUE AS DUCK FOOD.

Few who have written of the habits of sea brant have failed to mention its fondness for eel-grass. The relation between this species of bird and plant seems to be as close as, if not closer than, that existing between the noted fresh-water pair, the canvasback

duck and wild celery. So far as investigations of the food of the brant are concerned the published record is thoroughly substantiated. All normal stomach contents of the common brant thus far examined consisted exclusively of eel-grass. Other salt-water fowl also feed on eel-grass, as the surf and white-winged scoters. Six birds of the latter species collected at Netarts Bay, Oregon, had made 43 per cent of their last meal of it. The list of other ducks feeding on the plant includes the golden-eye, old squaw, bufflehead, mallard, and black duck, the last-named species sometimes devouring the seeds of

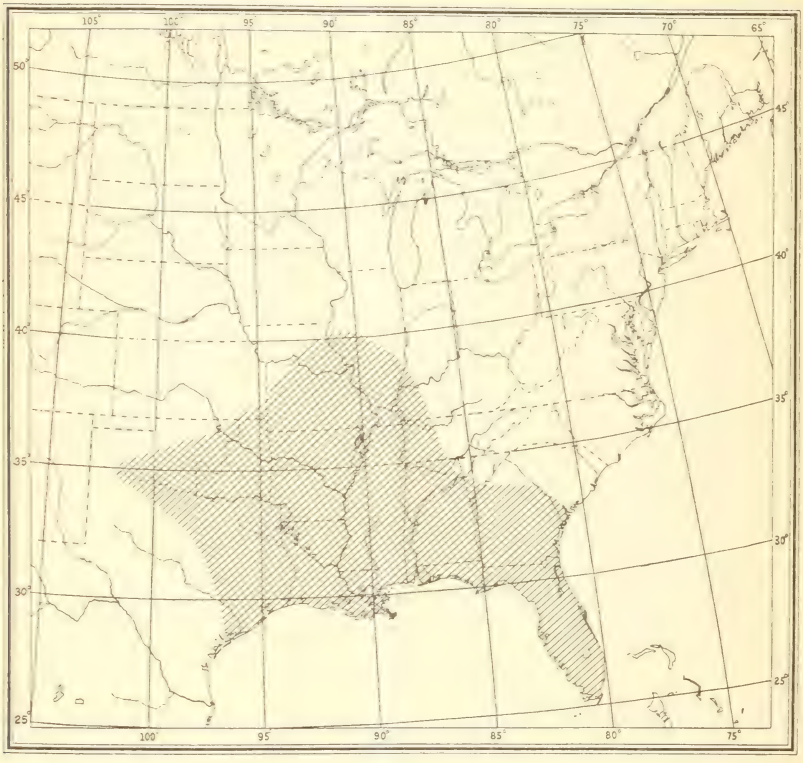


FIG. 12.—Range of swamp privet.

eel-grass in large numbers. The stomachs of 5 black ducks collected at Amityville, Long Island, N. Y., in October and November, contained on the average more than 66 per cent of eel-grass seeds, the number of seeds per stomach varying from 700 to 4,000. Eleven birds taken at Scarboro, Me., during the same months had eaten enough eel-grass seeds to make up 51 per cent of their food. In three cases fully 2,000 seeds had been taken. Thirteen ducks of the same species collected in Massachusetts in January and February had taken eel-grass, including both seeds and leaves, to the extent of more

than 11 per cent of their food. The wigeon, a species which prefers foliage to the seeds and roots of aquatic plants, sometimes visits salt water to feed upon this plant. Five of these birds taken at South Island, South Carolina, in February, had made one-fourth of their meal of the leaves of eel-grass.

#### DESCRIPTION OF PLANT.

Eel-grass (*Zostera marina*) consists of bunches of long tapelike leaves which rise from a jointed fibrous-rooted creeping stem (fig. 13). The leaves bear a strong superficial resemblance to those of wild celery, but they are rarely more than a fourth of an inch wide, while those of wild celery are seldom as narrow. The leaf of eel-grass, furthermore, is tougher and more leathery than that of wild celery. When a mature leaf is torn across, numerous white fibers may be seen at the broken ends. Wild celery lacks these. The color of eel-grass leaves is olive or dark green, that of wild celery clear light green.[1]

The leaves grow in small bundles from the end of the rootstock or its branches, and may reach a length of 6 feet. The rootstocks, which usually are reddish, have joints about every half inch, at which they are easily broken. The numerous fibrous roots spring from these joints. Seeds of eel-grass are formed in sheaths alongside the leaves. They are about one-eighth of an inch in length, are placed end to end, and are barrel-shaped, with the surface conspicuously longi-

FIG. 13.—Eel-grass.

[1] Under the microscope the leaves of these two plants are very unlike. The chlorophyll granules of *Zostera* are arranged in regular longitudinal rows, and the edge of the leaf is smooth. The chlorophyll granules of *Vallisneria*, on the contrary, are irregularly arranged and the edge of the leaf is sparingly beset with minute teeth.

tudinally ribbed (fig. 14). Eel-grass has numerous common names, among which we may cite sea-wrack or grass-wrack, sea-, sweet-, barnacle-, turtle-, and wigeon-grass.

#### DISTRIBUTION.

Eel-grass is strictly a maritime species. In its natural habitat it is cosmopolitan. In North America it is found from Greenland to the Gulf of Mexico, and from Alaska to California.

#### PROPAGATION.

This plant grows only in salt water. It is common along shores facing the open ocean, but also grows in bays and even lagoons where the water must be far less salt than the sea. The seeds are not well protected against drying and for that reason are unsuitable for transplanting.[1] Moreover, unless they can be sown in a very quiet place the chances are against securing a catch. The rootstocks, however, are rather tough and resistant and, furthermore, can be fastened to the bottom. They must not be allowed to dry, but should be shipped wet and handled as rapidly as possible. Bury or fasten to the bottom in water a few feet deep where there is little surf. Once established the plant will spread to more exposed areas.

FIG. 14.—Seeds of eel-grass.

### WIGEON-GRASS.

#### VALUE AS DUCK FOOD.

Wigeon-grass is of rather restricted range, but of considerable importance as a duck food almost everywhere it grows. In no locality, so far as known, is it more important than on the coast of Texas. Here the bays that have kept their wigeon-grass have kept their ducks; those in which the plant has been destroyed by influxes of mud and filling up of inlets have lost them. At Rockport, Tex., wigeon-grass still holds its own and is the main dependence of the visiting vegetarian ducks. About 64 per cent of the food of 33 pintails collected at Rockport in December was made up of rootstocks, leaves, and seeds of wigeon-grass. This plant furnished also two-thirds of the food of 3 wigeons, and more than 54 per cent of that of 37 redheads taken at the same time.

Records of the food of ducks on St. Vincent Island, Florida, show two other species of ducks to be very fond of this grass. Nineteen little bluebills collected in January had eaten it, principally the seeds, to the extent of over 63 per cent of their food, the number of seeds per stomach varying from 500 to 4,000. The food of 17 gadwells

[1] They undoubtedly can be preserved by cold storage in salt water, but considering the limited use that can be made of seeds on account of the heavy wash along most shores, this probably would not be profitable.

taken at the same time and place was 81 per cent wigeon-grass; and the stomach of a redhead contained about 5,120 seeds.

Most of the duck stomachs received by the Biological Survey from South Island, South Carolina, have contained wigeon-grass. It composed 41 per cent of the food of 3 blue-winged teals collected there in March, and 27 per cent of that of 8 gadwells obtained in February and March. In Currituck Sound, North Carolina, wigeon-grass grows among too great a profusion of other valuable duck foods to have the importance attained in less favored localities; nevertheless, it is a plant of considerable value. Practically 10 per cent of the food of 35 big bluebills collected there in November was composed of wigeon-grass, as was about the same proportion of the diet of 70 little bluebills. At Back Bay, Virginia, 17 per cent of the food of 9 pintails collected in February consisted of wigeon-grass, and at Virginia City, Va., 16 per cent of the food of 14 mallards taken in January was of the same composition.

Other ducks found feeding on wigeon-grass are the Florida duck, black duck, green-winged and cinnamon teals, spoonbill, canvasback, ringneck, bufflehead, old squaw, ruddy duck, surf scoter, and hooded merganser.

### DESCRIPTION OF PLANT.

Wigeon-grass (*Ruppia maritima*) is similar in habit to sago pondweed or foxtail.[1] Both have long, slender, filamentous leaves on widely spreading, much-branched stems. In wigeon-grass the basal parts of many of the leaves are enlarged (fig. 15), and this, upon close inspection, gives the plant quite a different appearance from sago pondweed. The seeds of sago pondweed are compactly grouped on a central axis, while those of wigeon-grass are borne singly on rather long stalks which radiate from the top of the fruiting peduncle (fig. 16). The latter organ usually is spirally coiled in wigeon-grass; in sago pondweed it never has more than a simple curve. The rootstock of wigeon-grass is tougher than that of sago pondweed, more frequently jointed, and often angled at the joints. There are no tubers. The seeds are black, rounded triangular in outline, with a small pit on each side near the apex, and on one edge an oblong lid which is forced out during germination. Pondweed seeds have a similar lid, but are usually larger than those of wigeon-grass, never black, and lack the apical pits.

Wigeon-grass is usually referred to in books as sea- or ditch-grass; it is also called tassel-grass, tassel-weed, tassel-pondweed, nigger-wool, puldoo-grass, and peter-grass. The last two names are compounded from terms by which the coot is known in southern States, and indicate that wigeon-grass is highly relished by that bird.

[1] Described in Biological Survey Circular No. 81, pp. 12–16.

### DISTRIBUTION.

Wigeon-grass is a brackish-water plant. It grows in salt water, but probably never in that of full ocean strength. It also grows in water that passes for fresh, as in the upper part of Currituck Sound,

FIG. 15.—Wigeon-grass.

North Carolina, but inlets from the ocean to this part of the sound have existed in recent years and high tides at times cross the narrow beach. Salt in the soil or salt springs, even if covered by fresh water, also give wigeon-grass the conditions necessary for existence; this

explains its scattering distribution in the interior of the country (fig. 17). Along the coasts wigeon-grass occurs from the base of the Alaska Peninsula and the Gulf of St. Lawrence south to Central America.[1]

### PROPAGATION.

Wigeon-grass may be propagated from the seeds, which ripen in late summer and early autumn. These should be gathered with about 6 inches of the upper part of the plant, as the foliage tends to keep them from drying. This material should not be packed in large masses, but free circulation of air should be provided to prevent fermentation. As little time as possible should intervene between gathering and planting. If it is desired to keep the seeds for some time they may be placed in wet cold storage.

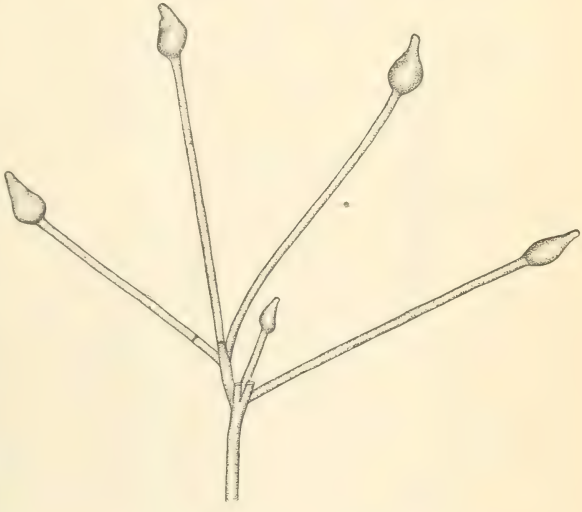

FIG. 16.—Fruits of wigeon-grass.

After soaking the seed until it will sink, sow broadcast, in quiet but not stagnant water over mud bottom. Wigeon-grass grows in water varying in depth from a few inches to 10 feet. It should be sown where the water is permanently 1 to 2 feet deep.

## THREE PLANTS FOR DUCK FARMS.

The plants considered under this head are distinguished by rankness of vegetative growth, comparative unimportance of their seeds as duck food, and lack of fleshy rootstocks and tubers. These qualities render the plants generally undesirable for propagation as wild-duck foods, but they are the very things which make them valuable for duck farms. As a rule abundant green food is available to wild ducks, but the birds usually have to search for seeds, fruits, tubers, and like forms of concentrated nutriment. The conditions on a game farm are just the reverse. The birds are supplied grain food constantly, but need roughage, particularly of naturally suitable kinds. Plants of rapid, luxuriant growth are necessary and all requirements are fulfilled by water-cress, water-weed, and coontail.

[1] Authorities hold a variety of views regarding the number of species of *Ruppia* which occur in this area. The purposes of this publication, however, are best served by grouping all the forms under one name.

### USE OF THESE PLANTS.

The three plants just mentioned are not recommended for planting in waters where any other growth is desired, since they are such rank growers that they are apt to take complete possession. One of them, namely, coontail, has considerable value as a wild-duck food, however, and may be tried in waters where other plants have failed.

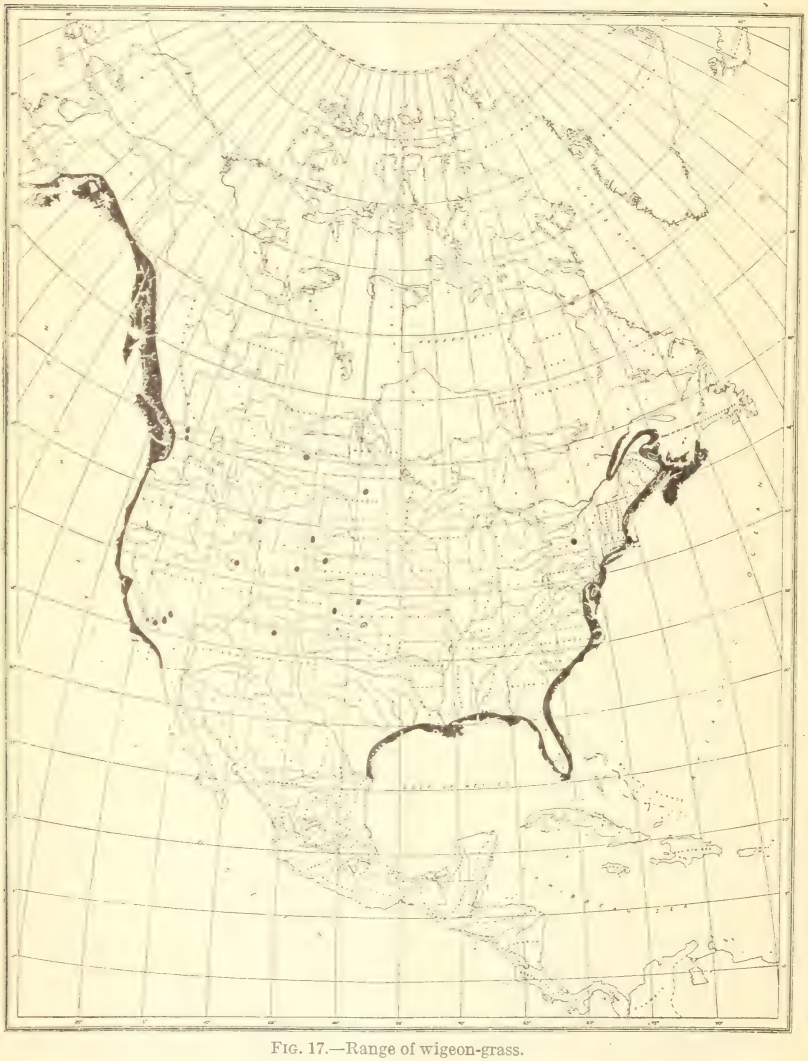

FIG. 17.—Range of wigeon-grass.

On duck farms best results will be obtained if the unit system of ponds be adopted. Ducks can be turned into one pond at a time, and when a pond is eaten out it may be resown, screened off, and allowed to make a new crop. Under favorable conditions waterweed and coontail will grow 6 inches a day.

## WATER-CRESS.

### VALUE AS DUCK FOOD.

Knowledge of the importance of water-cress as a duck food is derived entirely from breeders of wild ducks, who almost without exception consider it a valuable plant for a duck farm. Not only is it relished, but it is said to grow so fast in some places that the ducks can not eat it out.

### DESCRIPTION OF PLANT.

Water-cress (*Sisymbrium nasturtium-aquaticum*) either floats in the water, rooted only at the lower end, or creeps along on mud or in shallow water, throwing out roots at every joint. It is a smooth, fleshy plant, with divided leaves and small white flowers (fig. 18). The leaves consist of 3 to 9 symmetrically arranged oval or roundish segments, of which the apical of each leaf is the largest. The pods vary from one-half to one and one-fourth inches in length, are slightly curved, and contain numerous small seeds. There is a constant succession of flowers and pods throughout the growing season. The plant sometimes is strongly tinged with olive-brown, suggesting one of its common names, brown-cress. Other names are well-cress or -grass, water-kers, -kars, -karse, or -grass, crashes, and brook-lime.

FIG. 18.—Water-cress.

### DISTRIBUTION.

Water-cress occurs practically throughout the United States.

### PROPAGATION.

Water-cress usually is propagated by seed. This may be obtained from most seedsmen. The plant is also easily transplanted by cuttings. It grows in springs, brooks, small streams, and shallow ponds.

Waters in which it is found are usually cool and have some current. It may be sown in similar situations at any time during spring or summer.

## WATER-WEED.

### VALUE AS DUCK FOOD.

Evidence for the value of water-weed is of the same nature as for water-cress. The density and luxuriance of its growth are such that water-weed maintains its stand even when fed upon daily by a large number of ducks. Small quantities of the plant have been found in stomachs of the mallard, blue-winged teal, and goldeneye.

### DESCRIPTION OF PLANT.

Water-weeds (figs. 19 and 20) have long, branching stems with luxuriant foliage and are of a beautiful translucent green color. The leaves, which are set upon the stem in whorls of from 2 to 4 (usually 3), vary from ovate to strap-shaped, and may be pointed or obtuse, and are sometimes finely toothed. They are from one-fourth to one inch or more in length and from one-twelfth to one-eighth of an inch in width. The small flowers are borne on rather long stalks and open at the surface of the water. The fruit, which is rare, is few seeded and ripens under water.

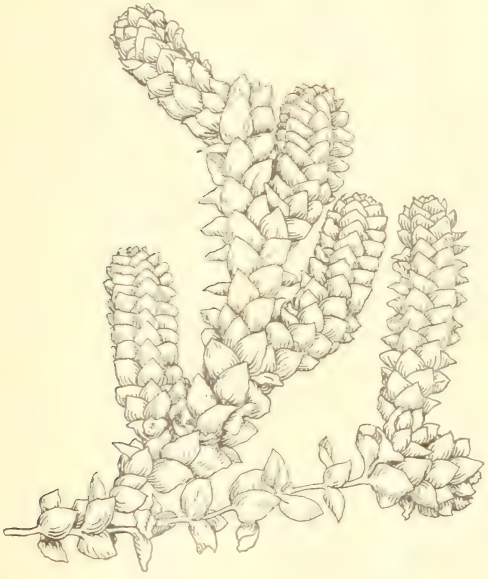

FIG. 19.—Water-weed. A compact form.

This plant was introduced into Great Britain in the middle of the nineteenth century, and spread rapidly, making such rank growth that it soon became a pest, filling ornamental waters, mill races, and canals. It became known there as American water-weed and Babington's curse (because introduced by a botanist of that name). Other names applied to the plant are ditch-moss, water-thyme, thyme-weed, cats-tails, and choke pondweed.

Some botanists consider that there are several different species of water-weed in the United States. But, having in mind the entirely different aspect wild plants of water-weed assume when transferred to an aquarium, one is inclined to think that differences in the forms,

which have been thought to represent distinct species, may be largely due to conditions under which the plants were grown.

Water-weed has had various scientific names applied to it, and the following may be encountered in trade catalogues: *Philotria*, *Elodea*, and *Anacharis*. The specific name that has been most commonly used in this country is *canadensis*. Dealers in aquarium plants usually list a form of water-weed known as *Anacharis canadensis gigantea*.

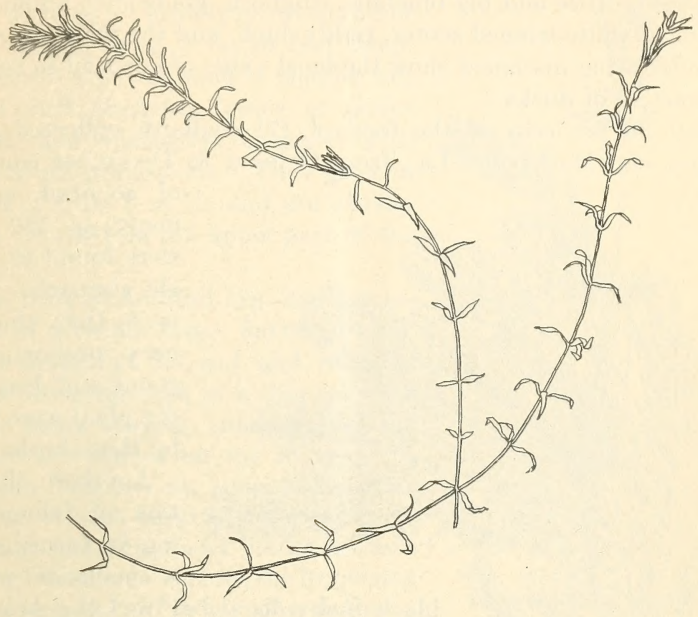

FIG. 20.—Water-weed. A diffuse form.

#### DISTRIBUTION.

Water-weeds grow naturally throughout most of North America.

#### PROPAGATION.

Water-weed propagates itself from pieces of leafy stem or root. It is tenacious of life, and if shipment in good condition is achieved, no trouble will be experienced in obtaining a stand of the plant. Bury the roots or bases of stems in the bottom in shallow water for quick results. The plant will grow, however, if only thrown in water shallow enough (3 feet or less) to allow it to send roots to the bottom. It likes a loam or sandy loam and does not grow in clay. Either still or running waters are suitable. When established it will spread to water up to 10 feet in depth.

## COONTAIL.

### VALUE AS DUCK FOOD.

The seeds of coontail are eaten by practically all wild ducks, but the foliage by a much smaller number and less frequently. Ducks known to feed on this plant are the following: Hooded merganser, mallard, black duck, Florida duck, gadwell, wigeon, green-winged and blue-winged teals, spoonbill, pintail, wood duck, redhead, canvasback, little and big bluebills, ringneck, goldeneye, buffle-head, old squaw, white-winged scoter, ruddy duck, and the whistling swan.

The following instances show the local value of coontail to some of these species of ducks:

About 30 per cent of the food of 171 mallards collected about Mansura and Marksville, La., from October to December consisted of coontail, and as many as 150 seeds were found in a single stomach. Much more than the ordinary proportion of stems and leaves of the plant were taken by these birds.

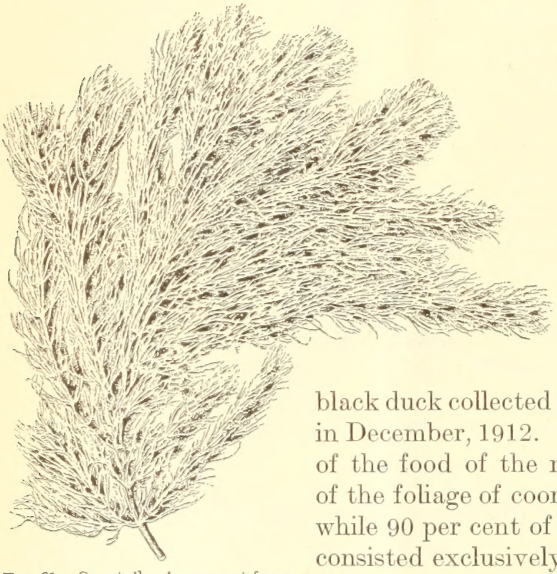

FIG. 21.—Coontail. A compact form.

Another illustration of foliage eating is furnished by 8 mallards and 1 black duck collected at Big Lake, Arkansas, in December, 1912. More than 85 per cent of the food of the mallards was made up of the foliage of coontail, with a few seeds, while 90 per cent of the black duck's food consisted exclusively of coontail foliage.

Sixty-four mallards collected at Menesha, Ark., in November and December, 1909, had fed on coontail seeds to the extent of 7.23 per cent of their diet. Fourteen of the same species of duck, taken at Lake Wapanoca, Arkansas, in November, 1910, had eaten enough seeds, with a little foliage of coontail, to form on the average more than half of their food.

The plant thus has considerable local value as a wild-duck food. However, its tendency to crowd out more desirable species makes transplanting unwise, unless in particularly difficult cases where other plants have failed. The very qualities of coontail that make it a nuisance in natural waters commend it to duck farmers.

### DESCRIPTION OF PLANT.

The stems of coontail (*Ceratophyllum demersum*) are thickly clothed with round, dense masses of foliage (figs. 21 and 22), which in shape amply justify the common name so widely used in the South, and which is here adopted for the plant. Coontail is a submerged plant, but only exceptionally is it attached to the bottom, as it has no roots; it usually grows in rather quiet waters from 2 to 10 feet deep. The leaves are composed of slender but rather stiff filaments, twice or thrice forked, and sparingly furnished with small acute projections. They grow in whorls of from 5 to 12, and are usually much crowded on the upper part of the stem.

FIG. 22.—Coontail. A diffuse form.

The fruit of coontail (fig. 23) is composed of a rather large, flattened seed, wedge-shaped at one end and rounded at the other, inclosed in a thin covering which bears various tubercles on the surface and spines on the margin. A common form has one spine at the apex and one at each basal angle of the fruit. One may examine many plants without finding fruit; nevertheless, the frequency with which ducks find it proves that a good crop is produced. Coontail is known also as hornwort, hornweed, morass-weed, coontail moss, fish-blankets, and June grass.

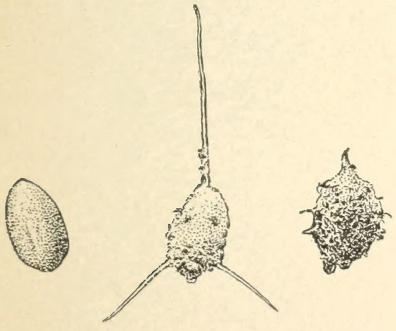

FIG. 23.—Seeds and fruit of coontail.

### DISTRIBUTION.

Coontail is practically cosmopolitan and occurs throughout all but the extreme northern parts of North America.

### PROPAGATION.

Pieces of coontail broken off from the parent plant promptly make new colonies, a characteristic which makes transplanting easy. Care need be taken only to see that the plants do not lose their vitality either through drying or fermentation during shipment.

Plant in quiet water. As the plant has no roots, it is enabled to thrive over hard or sandy bottoms where many other plants can not establish themselves.

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